Approval Specification

Customer : IT事 **DATE : 09 / Nov. / 2011**

SAMSUNG TFT-LCD

MODEL : LTM270HU02-V

Any Modification of Specification is not allowed without SEC's Permission.

NOTE :

Customer's Approval	
SIGNATURE	DATE

PREPARED BY	DATE 09/Nov /'11
APPROVAED BY	DATE 09/Nov/'11

Application Engineering Group

LCD Business, Samsung Electronics Co . , LTD.

wise view™ SAMSUNG TFT-LCD

Product Configuration Approval Sheet

Approval Specification

Description

Items	Content
Date of Approval	
Customer	IT事
Product Name	LTM270HU02-V
Project Name	Neptune

Customer System Configuration

Items		Content
System Name		Neptune
Purpose		All-in-one
IC	Scaler	
	Inverter	
Power		
Input Interface		HDMI / DVI
PART No.		

Notice : SEC product approval spec guarantee a above customer system.

Contents

Approval Specification

* Revision History

Date	Rev. No	Page	Summary
Nov. 9, 2011	000	All	Approval specification of LTM270HU02 model was issued first.

General Description

Description

LTM270HU02 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 23.0” is 1920 x 1080 and this model can display up to 16.7 millions colors.

Features

- High contrast ratio, high aperture structure
- High speed response
- FHD (1920 x 1080 pixels) resolution
- White LED Edge slim Backlight (Horizontal)
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface (4pixel/clock)
- RoHS, Halogen Free
- TCO 5.0 compliance
  (Except for 2.2 response time; this product does not have over driving function.
  It is recommended to support in system level)

Applications

- Workstation & desktop monitors
- Display terminals for AV application products
- Monitors for industrial machine
  * If the module is used to other applications besides the above, please contact SEC in advance.

General Information

Items	Specification	Unit	Note
Pixel Pitch	0.31125(H) x 0.31125(W)	mm	
Active Display Area	597.60(H) x 336.15(V)	mm	
Surface Treatment	Glare 4%, Hard coating (2H)		
Display Colors	16.7M (Hi-FRC)	colors	
Number of Pixels	1,920 x 1,080	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally White		
Luminance of White	300(Typ.)	cd/㎡	

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal (H)	610.5	611.0	611.5	mm	w/o inverter ass'y
	Vertical (V)	369.6	370.1	370.6	mm	
	Depth (D)	6.3	6.8	7.3	mm	
Weight		-	-	2,200	g	LCD module only

Note (1) Mechanical tolerance is ± 0.5mm unless there is a special comment.

1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	GND-0.5	5.5	V	(1)
Storage temperature	T_{STG}	-20	60	℃	(2)
Operating Temperature	T_{OPR}	0	50	℃	(2)
Center of Glass surface temperature (Operation condition)	T_{OPR}	0	65	℃	(6)
Shock (non - operating)	S_{nop}	-	50	G	(3)(5)
Vibration (non - operating)	V_{nop}	-	1.5	G	(4)(5)

Note (1) Ta= 25 ± 2 °C

(2) Temperature and relative humidity range are shown in the figure below.
a. 90 % RH Max. (Ta ≤ 39 °C)
b. Maximum wet-bulb temperature at 39 °C or less. (Ta ≤ 39 °C)
c. No condensation
(3) 11ms, sine wave, one time for ±X, ±Y, ±Z axis
(4) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis
(5) At vibration and shock test, the fixture which holds the module to be tested has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.
(6) The maximum operating temperature of LCD module is defined with surface temperature of active area. Under any condition the maximum ambient operating temperature should be keeping the surface of active area not any higher than 65°C.

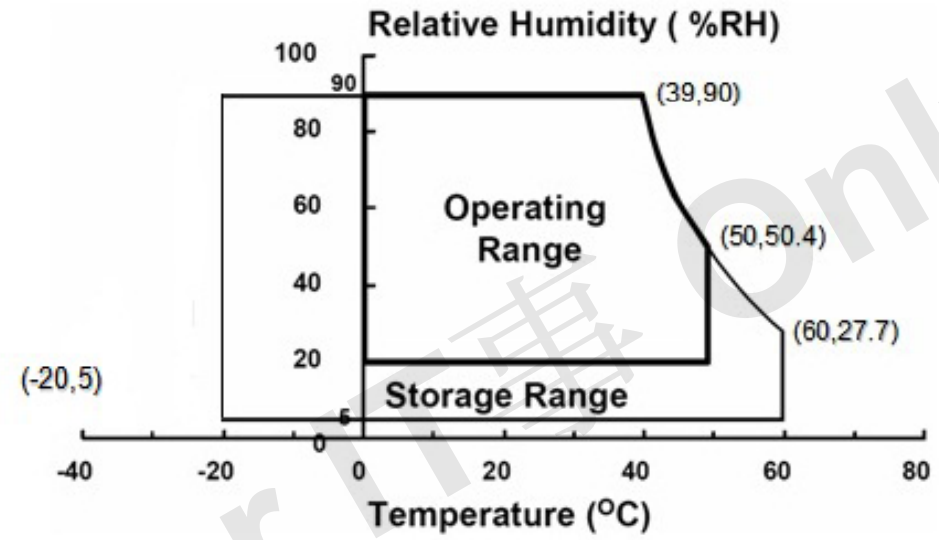


Fig. Temperature and Relative humidity range

2. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : SR-3, RD-80S (TOPCON), EZ-Contrast (Eldim)

(Ta = 25 ± 2°C, VDD=5V, fv= 120Hz, fDCLK=74.3MHz(@ 2D), If =68mA/ch)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		700	1,000	-		(3) SR-3
Response Time(On/Off)		Tr + Tf		-	3	4	msec	(5) RD-80S
Luminance of White (Center of screen)		Y_L		250	300	-	cd/m^2	(6) SR-3
Color Chromaticity (CIE 1931)	Red	Rx	Normal $\theta_{L,R}$=0 $\theta_{U,D}$=0 Viewing Angle	-0.030	0.651	+0.030		(7),(8) SR-3
		Ry			0.333			
	Green	Gx			0.319			
		Gy			0.624			
	Blue	Bx			0.151			
		By			0.057			
	White	Wx			0.313			
		Wy			0.329			
Color Chromaticity (CIE 1976)	Red	Ru'		-	0.457	-		
		Rv'		-	0.526	-		
	Green	Gu'		-	0.130	-		
		Gv'		-	0.570	-		
	Blue	Bu'		-	0.179	-		
		Bv'		-	0.152	-		
	White	Wu'		-	0.198	-		
		Wv'		-	0.468	-		
C.G.L (ACC ONLY)	White	△u'v'		-	-	0.02		(9)

* C.G.L : Color Grayscale Linearity

(continue to the next page)

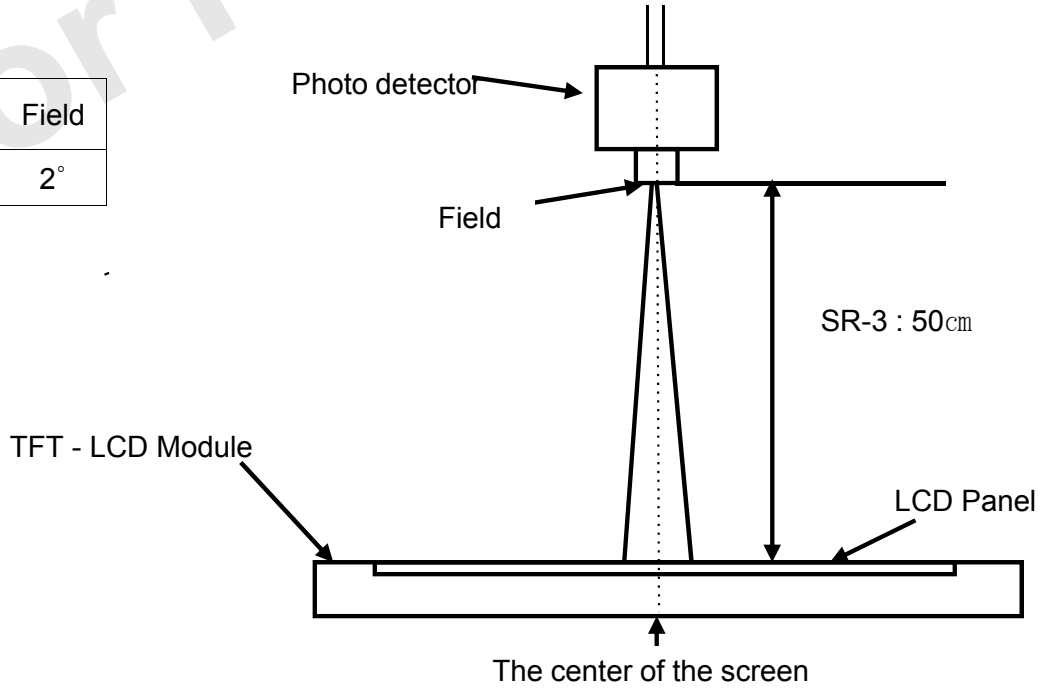
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Gamut		-		-	72	-	%	
Color Temperature		-		-	6500	-	K	
Viewing Angle	Hor.	θ_L	CR≥10(5)	70(80)	85(89)	-	Degrees	(8) EZ-Contrast
		θ_R		70(80)	85(89)	-		
	Ver.	θ_U		70(80)	80(89)	-		
		θ_D		70(80)	80(89)	-		
Brightness Uniformity (9 Points)		B_{uni}		-	-	25	%	(4) SR-3

Note (1) Test Equipment Setup

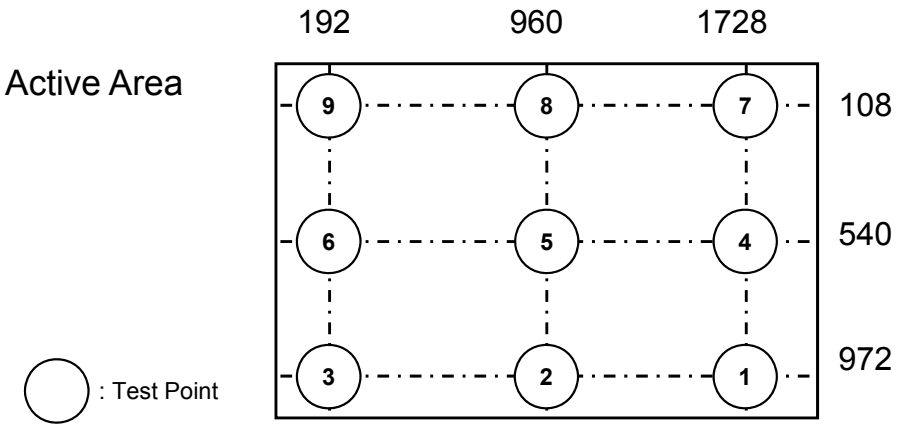
The measurement should be executed in a stable, windless and dark room between 30min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

LED Forward current : If = 68mA/ch Environment condition : Ta = 25 ± 2 °C

Photo detector	Field
SR-3	2°



Note (2) Definition of test point



Note (3) Definition of Contrast Ratio (C/R)

: Ratio of gray max (Gmax) & gray min (Gmin) at the center point⑤ of the panel

$$CR = \frac{G\max}{G\min}$$

Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

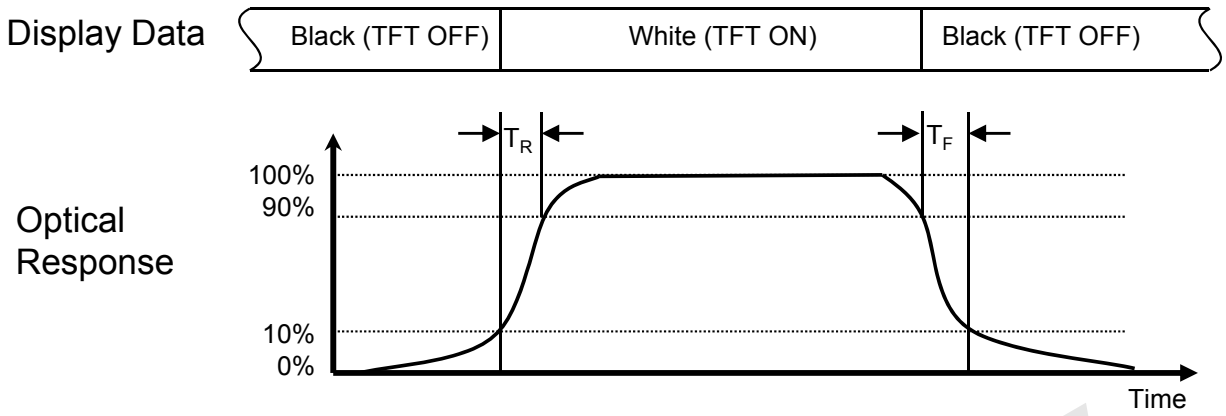
Note (4) Definition of 9 points brightness uniformity

$$Buni = 100 \times \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness with all pixels white
Bmin : Minimum brightness with all pixels white

Note (5) Definition of Response time

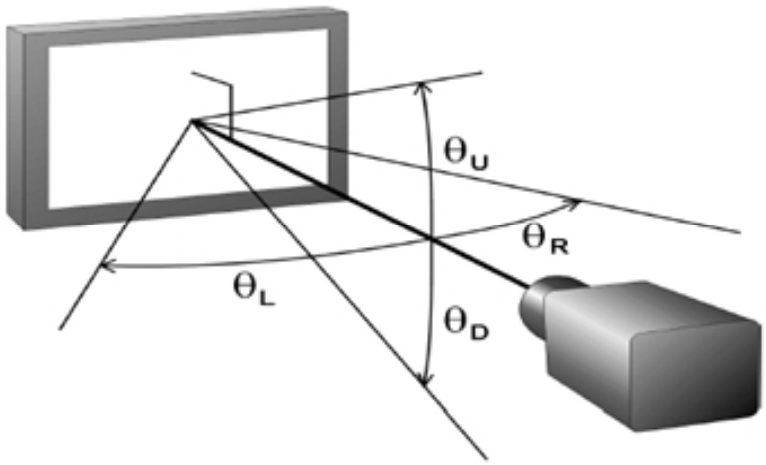
a. On/Off response time : Sum of Tr, Tf



Note (6) Definition of Luminance of White : Luminance of white at center point⑤

Note (7) Definition of Color Chromaticity (CIE 1931, CIE1976)
Color coordinate of Red, Green, Blue & White at center point⑤

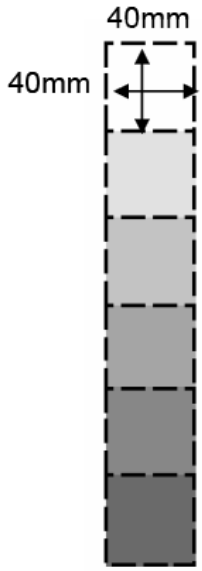
Note (8) Definition of Viewing Angle
: Viewing angle range (CR ≥10)



Note (9) Color Grayscale Linearity

a. Test image : 100% full white pattern with a test pattern as below

b. Test pattern : Squares, 40mm by 40mm in size, filled with 255, 225, 195, 165, 135 and 105 grays steps should be arranged at the center⑤ of the screen.



c. Test method

-1st gray step : move a square of 255 gray level should be moved into the center of the screen and measure luminance and u' and v' coordinates.

- Next gray step : Move a 225 gray square into the center and measure both luminance and coordinates, too.

d. Test evaluation

$$\Delta u'v' = \sqrt{(u'_A - u'_B)^2 + (v'_A - v'_B)^2}$$

Where A, B : 2 gray levels found to have the largest color differences between them

i.e. get the largest Δu' and Δv' of each 6 pair of u' and v' and calculate the Δu'v'.

3. Electrical Characteristics

3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C

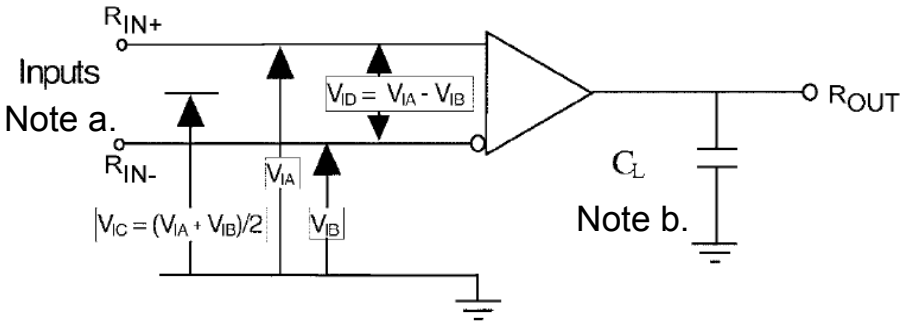
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	4.5	5.0	5.5	V	(1)
LVDS Input Characteristics	Differential Input Voltage for LVDS Receiver Threshold	High	-	-	+100	mV	(2)
		Low	-100	-	-	mV	
	LVDS skew	t_{SKEW}	-300		300		(3)
	Differential input voltage	$\|V_{ID}\|$	200		600	mV	(4)
	Input voltage range (single-ended)	V_{IN}	0		2.4	V	(4)
	Common mode voltage	V_{CM}	0+ $\|V_{ID}\|/2$	1.2	2.4- $\|V_{ID}\|/2$	V	(4)
Current of Power Supply	(a) Black	I_{DD}	-	1,600	-	mA	(5),(6)
	(b) White		-	1,000	-	mA	
	(c) Dot		-	2,200	3,200	mA	
Rush Current		I_{RUSH}	-	-	5.0	A	(7)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

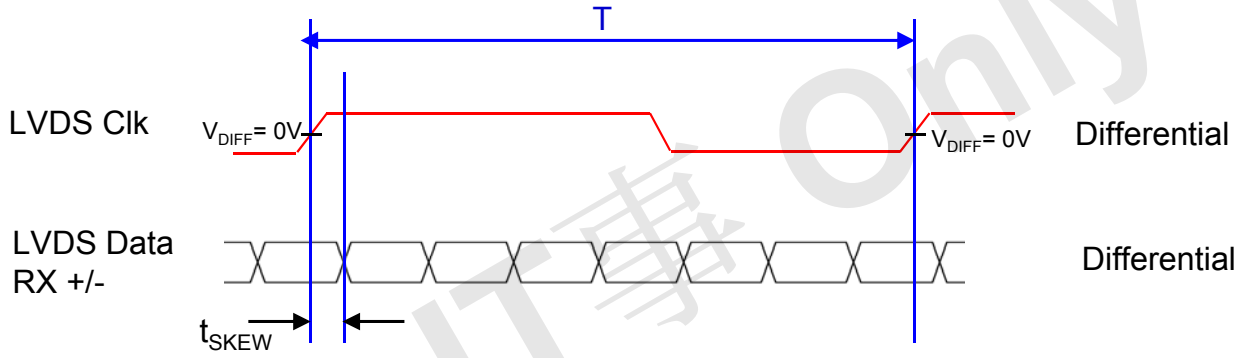
(2) Differential receiver voltage definitions and propagation delay and transition time test circuit

a. All input pulses have frequency = 10MHz, t_R or t_F=1ns

b. C_L includes all probe and fixture capacitance



(3) LVDS Receiver DC parameters are measured under static and steady conditions which may not be reflective of its performance in the end application.

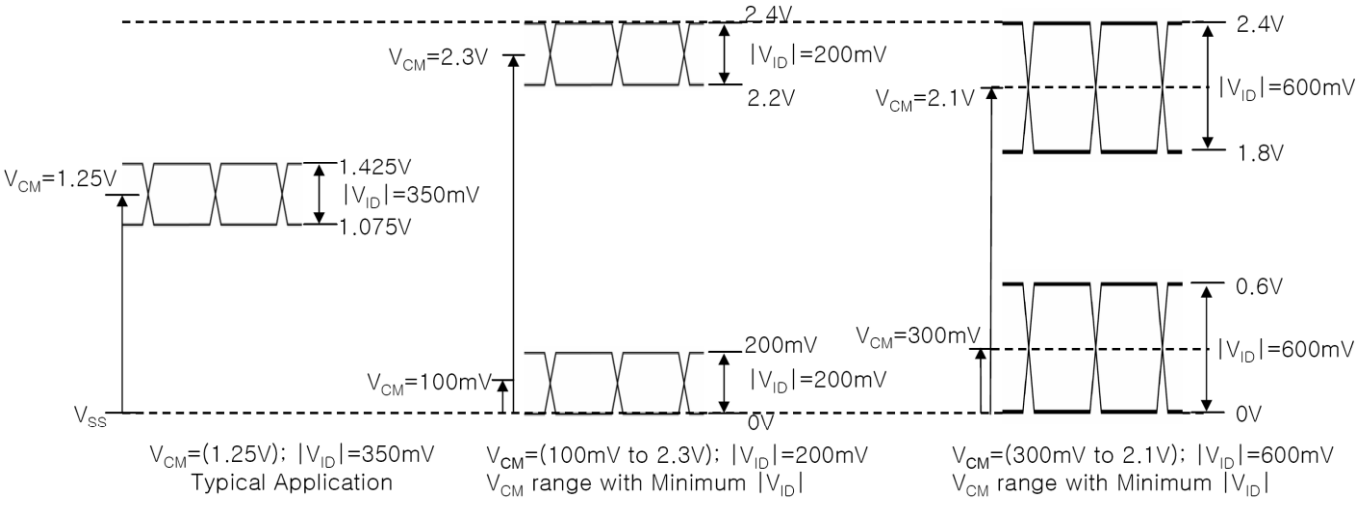


where tskew : skew between LVDS clock & LVDS data,

T : 1 period time of LVDS clock

cf) (-/+) of 300psec means LVDS data goes before or after LVDS clock.

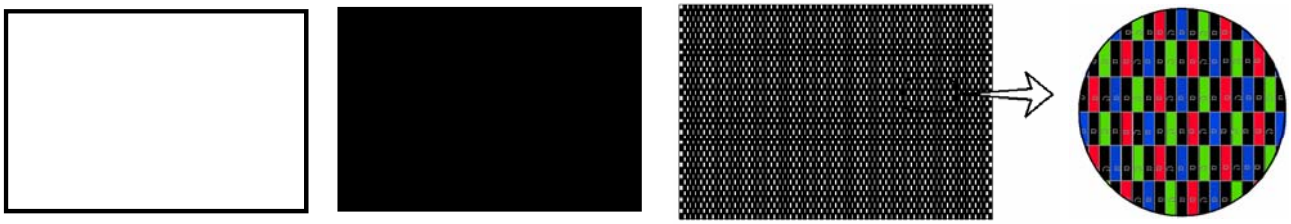
(4) Definition of V_{ID} and V_{CM} using single-end signals



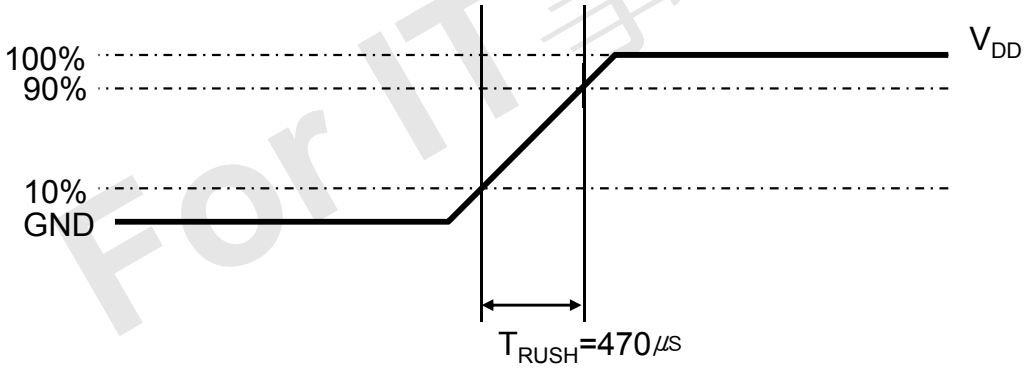
(5) fV=120Hz, fDCLK = 74.3MHz(@ 2D), VDD = 5.0V, DC Current.

(6) Power dissipation check pattern (LCD Module only)

a) White Pattern b) Black Pattern c) Dot Pattern



(7) Measurement Condition



Rush Current I_{RUSH} can be measured when T_{RUSH}. is 470μs.

3.2 Back Light Unit

3.2.1 The characteristics of LED bar

The back light unit is composed of WLED.

Ta=25 ± 2°C

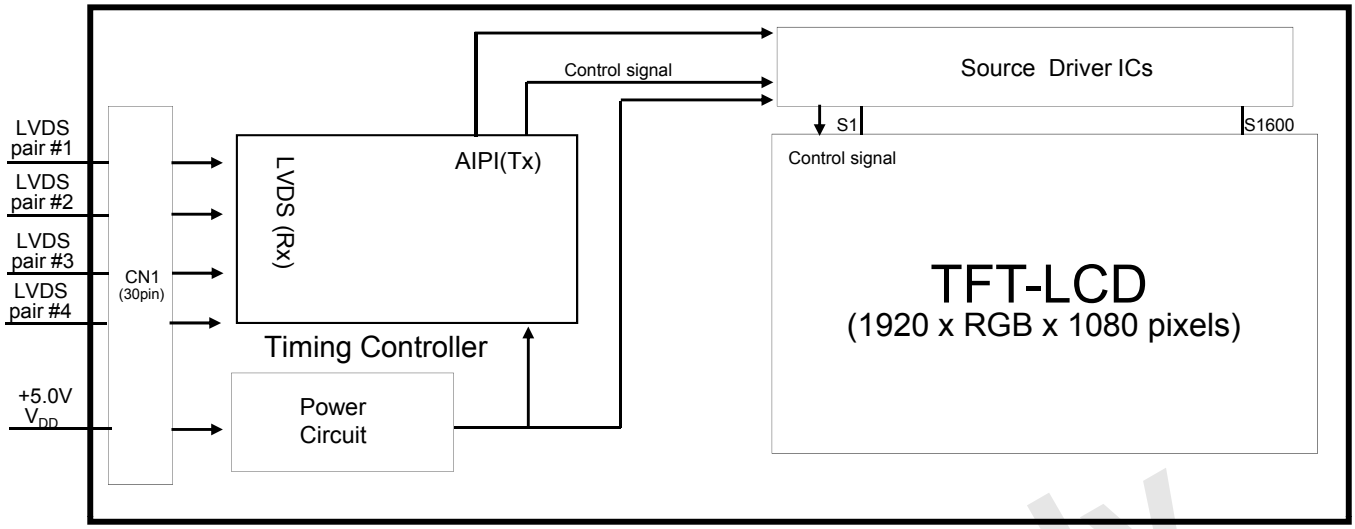
Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Current	I_F	-	68	70	mA	/ch (1)
LED Forward Voltage	V_f	2.9	3.2	3.5	V	1 LED
LED Array Voltage	V_P	-	64.0	70.0	V	-
Operating Life Time	Hr	30,000	-	-	Hour	(2)

Note (1) The above specification is not for the converter output, but for the LED bar.
The LED bar consists of 120 LED packages ; 6 parallel X 20 serial

(2) Life time (Hr) is defined as the time when brightness of a LED package itself becomes 50% or less than its original value at the condition of Ta=25 ± 2°C and I_F = 68mA/ch.

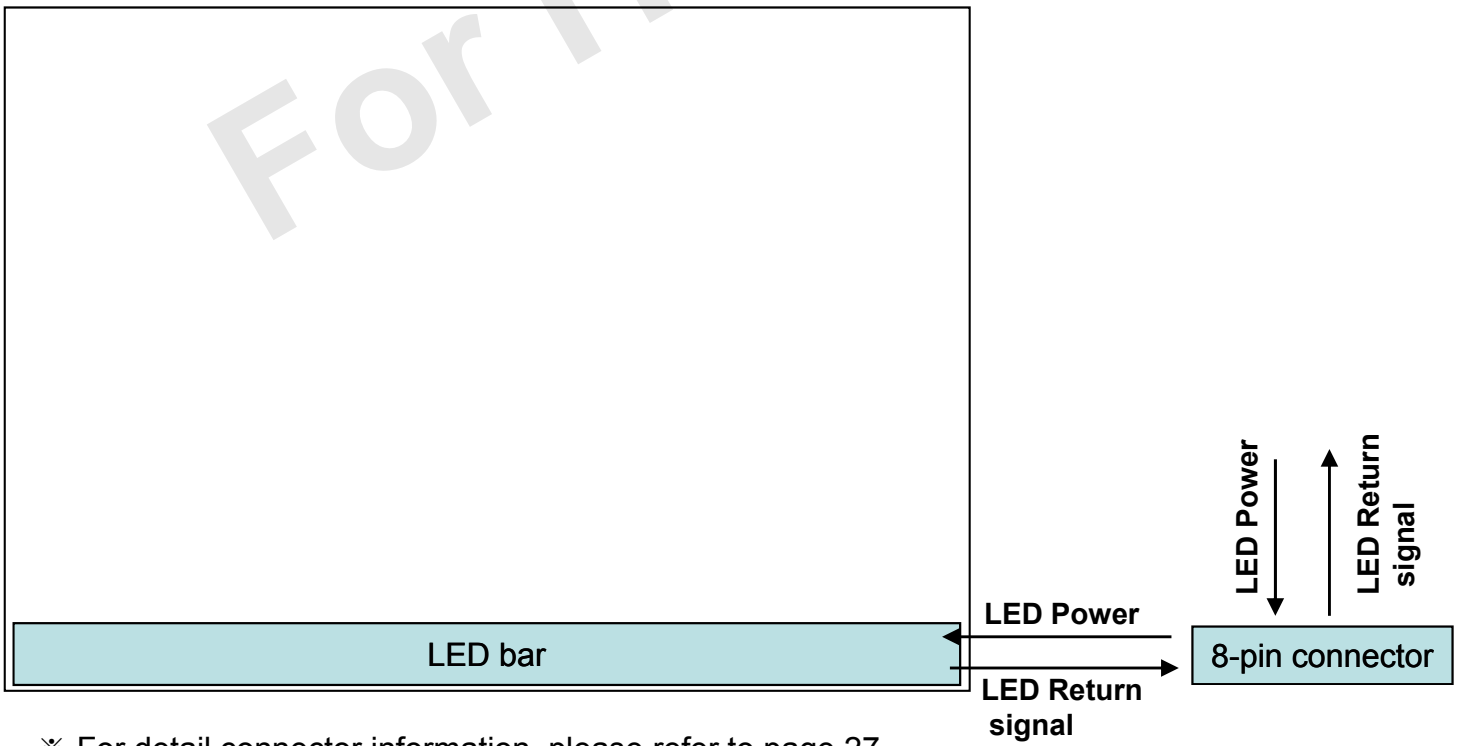
4. BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Back Light Unit

Connector: Molex 104086-0410
(mating CNT : Molex 104085-0400, 104085-0410)



※ For detail connector information, please refer to page 27.

5. Input Terminal Pin Assignment

5.1. Input Signal & Power (Connector : SD-104066-001, Molex or equivalent)

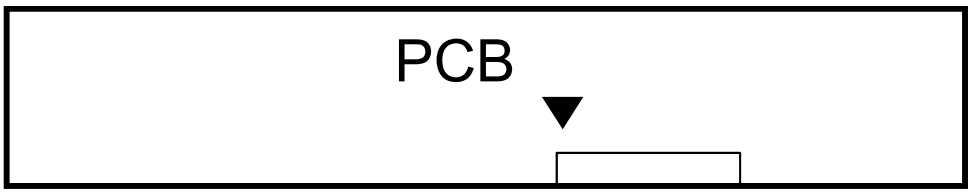
PIN NO	SYMBOL	FUNCTION
1	F_RXO0N	F_Negative Transmission Data of Pixel 0 (ODD data)
2	F_RXO0P	F_Positive Transmission Data of Pixel 0 (ODD data)
3	F_RXO1N	F_Negative Transmission Data of Pixel 1 (ODD data)
4	F_RXO1P	F_Positive Transmission Data of Pixel 1 (ODD data)
5	F_RXO2N	F_Negative Transmission Data of Pixel 2 (ODD data)
6	F_RXO2P	F_Positive Transmission Data of Pixel 2 (ODD data)
7	GND	Power Ground
8	F_RXOCN	F_Negative Sampling Clock (ODD data)
9	F_RXOCP	F_Positive Sampling Clock (ODD data)
10	GND	Power Ground
11	F_RXO3N	F_Negative Transmission Data of Pixel 3 (ODD data)
12	F_RXO3P	F_Positive Transmission Data of Pixel 3 (ODD data)
13	GND	Power Ground
14	F_RXE0N	F_Negative Transmission Data of Pixel 0 (EVEN data)
15	F_RXE0P	F_Positive Transmission Data of Pixel 0 (EVEN data)
16	F_RXE1N	F_Negative Transmission Data of Pixel 1 (EVEN data)
17	F_RXE1P	F_Positive Transmission Data of Pixel 1 (EVEN data)
18	F_RXE2N	F_Negative Transmission Data of Pixel 2 (EVEN data)
19	F_RXE2P	F_Positive Transmission Data of Pixel 2 (EVEN data)
20	GND	Power Ground
21	F_RXECN	F_Negative Sampling Clock (EVEN data)
22	F_RXECP	F_Positive Sampling Clock (EVEN data)
23	GND	Power Ground
24	F_RXE3N	F_Negative Transmission Data of Pixel 3 (EVEN data)
25	F_RXE3P	F_Positive Transmission Data of Pixel 3 (EVEN data)
26	GND	Power Ground
27	B_RXO0N	B_Negative Transmission Data of Pixel 0 (ODD data)
28	B_RXO0P	B_Positive Transmission Data of Pixel 0 (ODD data)
29	B_RXO1N	B_Negative Transmission Data of Pixel 1 (ODD data)
30	B_RXO1P	B_Positive Transmission Data of Pixel 1 (ODD data)

PIN NO	SYMBOL	FUNCTION
31	B_RXO2N	B_Negative Transmission Data of Pixel 2 (ODD data)
32	B_RXO2P	B_Positive Transmission Data of Pixel 2 (ODD data)
33	GND	Power Ground
34	B_RXOCN	B_Negative Sampling Clock (ODD data)
35	B_RXOCP	B_Positive Sampling Clock (ODD data)
36	GND	Power Ground
37	B_RXO3N	B_Negative Transmission Data of Pixel 3 (ODD data)
38	B_RXO3P	B_Positive Transmission Data of Pixel 3 (ODD data)
39	GND	Power Ground
40	B_RXE0N	B_Negative Transmission Data of Pixel 0 (EVEN data)
41	B_RXE0P	B_Positive Transmission Data of Pixel 0 (EVEN data)
42	B_RXE1N	B_Negative Transmission Data of Pixel 1 (EVEN data)
43	B_RXE1P	B_Positive Transmission Data of Pixel 1 (EVEN data)
44	B_RXE2N	B_Negative Transmission Data of Pixel 2 (EVEN data)
45	B_RXE2P	B_Positive Transmission Data of Pixel 2 (EVEN data)
46	GND	Power Ground
47	B_RXECN	B_Negative Sampling Clock (EVEN data)
48	B_RXECP	B_Positive Sampling Clock (EVEN data)
49	GND	Power Ground
50	B_RXE3N	B_Negative Transmission Data of Pixel 3 (EVEN data)
51	B_RXE3P	B_Positive Transmission Data of Pixel 3 (EVEN data)
52	GND	Power Ground
53	Frame_sel	3D_enable signal
54	PWMI	PWMI signal
55	NC(ELIT_EN)	Edge-lit
56	BIST_EN	Fail Mode Bist Enable
57	NC(Sync_o)	3D Glasses Control
58	GND	
59	STV	LED Driver (sunlight_M)
60	SCLK	
61	SDATA	
62	GND	Power Ground
63	GND	Power Ground

PIN NO	SYMBOL	FUNCTION
64	NC(CE)	* CE(For LCD internal use only. Do not connect)
65	NC(CTL)	* CTL(For LCD internal use only. Do not connect)
66	NC	No Connection
67	VIN_5V	Module Power input
68	VIN_5V	
69	VIN_5V	
70	VIN_5V	
71	VIN_5V	
72	VIN_5V	
73	GND	Power Ground
74	GND	Power Ground
75	FB1	LED Return Channel 1
76	FB2	LED Return Channel 2
77	FB3	LED Return Channel 3
78	VCC_LED	LED Power input 1
79	VCC_LED	LED Power input 2
80	FB4	LED Return Channel 4
81	FB5	LED Return Channel 5
82	FB6	LED Return Channel 6

* If the system already uses the 64, 65pins, it should keep under GND level
The voltage applied to those pins should not exceed -200mV.

Note) Pin number starts from left side



Pin No. 1 Pin No. 82

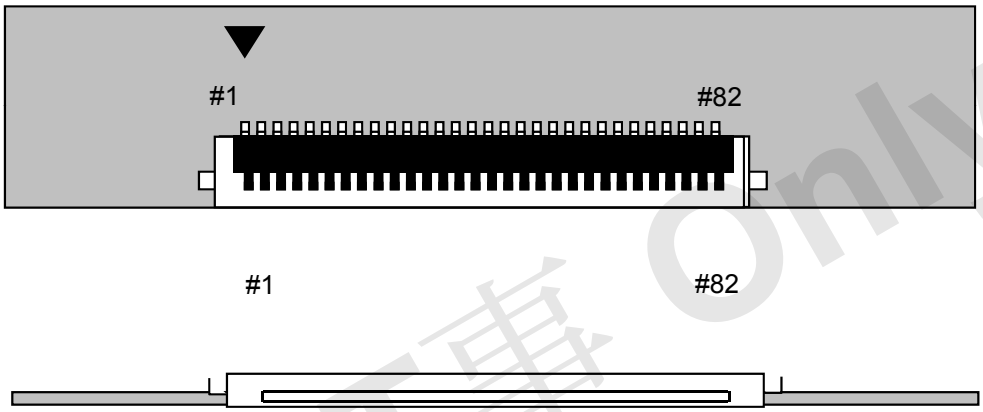
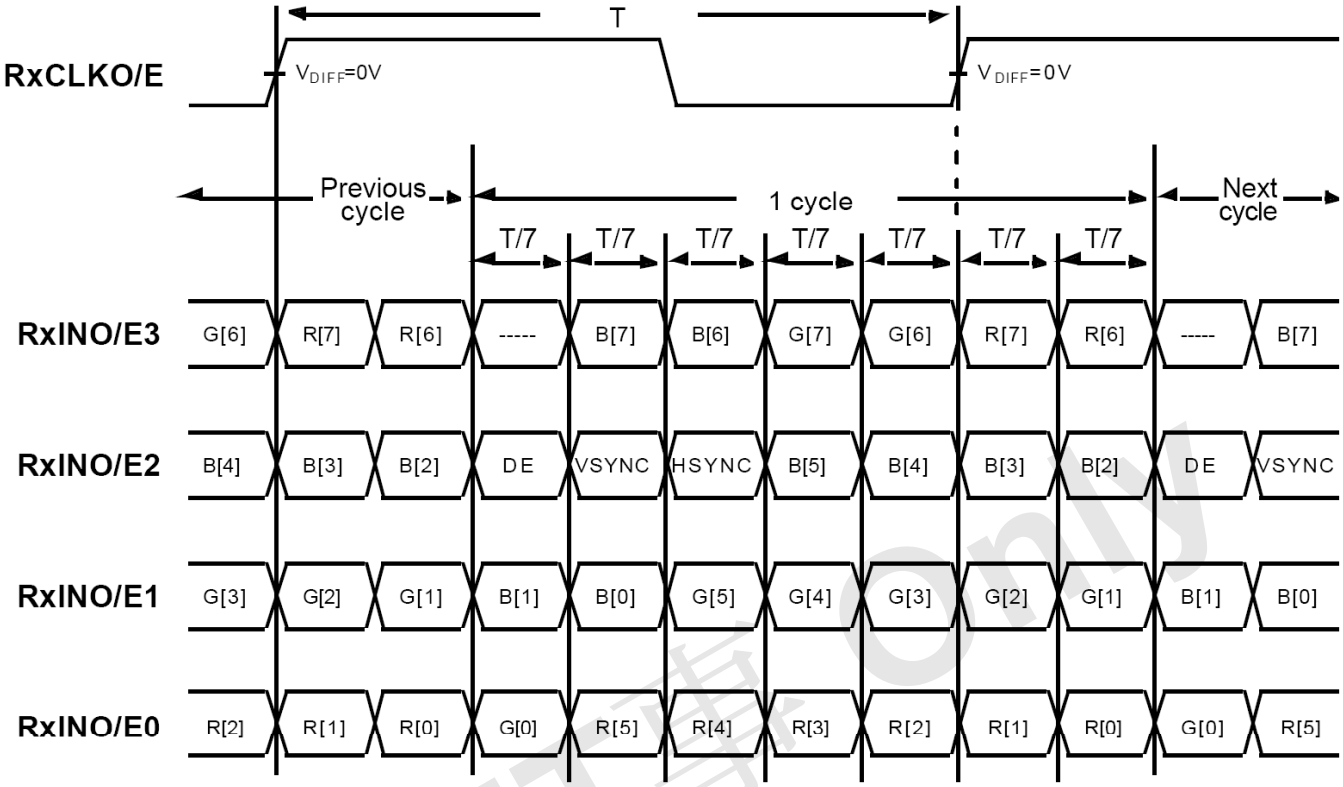


Fig. Connector diagram

a. All GND pins should be connected together and also be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All NC pins should be separated from other signal or power.

5.2 Timing Diagrams of LVDS For Transmitting

LVDS Receiver : Integrated T-CON



5.3 Back Light Unit

LED Bar input connector : Molex 104086-0410
(mating CNT : Molex 104085-0400, 104085-0410)

Pin No.	Pin description	Function
1	RTN 1	Channel 1 LED return
2	RTN 2	Channel 2 LED return
3	RTN 3	Channel 3 LED return
4	VCC 1	LED power input 1
5	VCC 2	LED power input 2
6	RTN 4	Channel 4 LED return
7	RTN 5	Channel 5 LED return
8	RTN 6	Channel 6 LED retrun

Note) Pin number starts from Left side

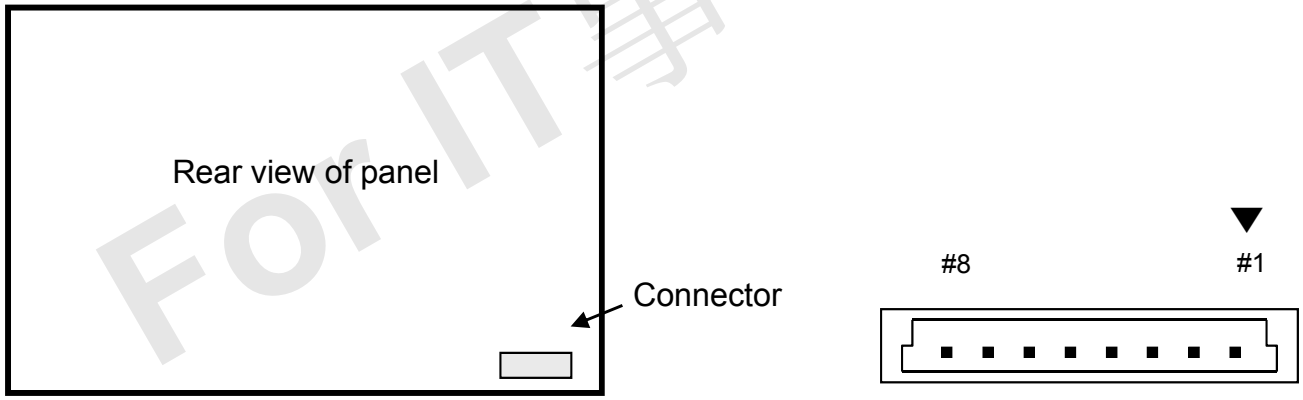


Fig. Connector diagram

5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~ R252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~ G252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~ B252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

Note (1) Definition of Gray :
Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)
Input Signal : 0 = Low level voltage, 1 = High level voltage

6. Interface Timing

6.1 Timing Parameters (DE only mode)

6.1.1 Monitor

SIGNAL	ITEM	SYM BOL	MIN.	TYP.				MAX.	Unit	NOTE
				2D MODE		3D MODE				
Clock	Frequency	$1/T_C$	72.5	74.3	74.3	104.0	104.0	108	MHz	-
Hsync		F_H	112	112.5	135	165	198	202	KHz	-
Vsync		F_V	100	100	120	150	180	182	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	1080	1080	1080	1080	-	lines	-
	Vertical Total	T_{VB}	-	1125	1125	1095	1095	-	lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	2640	2200	2520	2100	-	Clocks	4pixel/ clock
	Horizontal Total	T_H	-	1920	1920	1920	1920	-	clocks	4pixel/ clock

6.1.2 MFM (Multi Function Monitor)

SIGNAL	ITEM	SYM BOL	MIN.	TYP.				MAX.	Unit	NOTE
				2D MODE		3D MODE				
Clock	Frequency	$1/T_C$	72.5	74.3	74.3	105.8	105.8	108	MHz	-
Hsync		F_H	112	118.0	141.6	201.6	201.6	202	KHz	-
Vsync		F_V	100	100	120	150	180	182	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	1080	1080	1080	1080	-	lines	-
	Vertical Total	T_{VB}	-	1180	1180	1278	1110	-	lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1920	1920	1920	1920	-	Clocks	4pixel/ clock
	Horizontal Total	T_H	-	2520	2100	2100	2100	-	clocks	4pixel/ clock

Note (1) This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

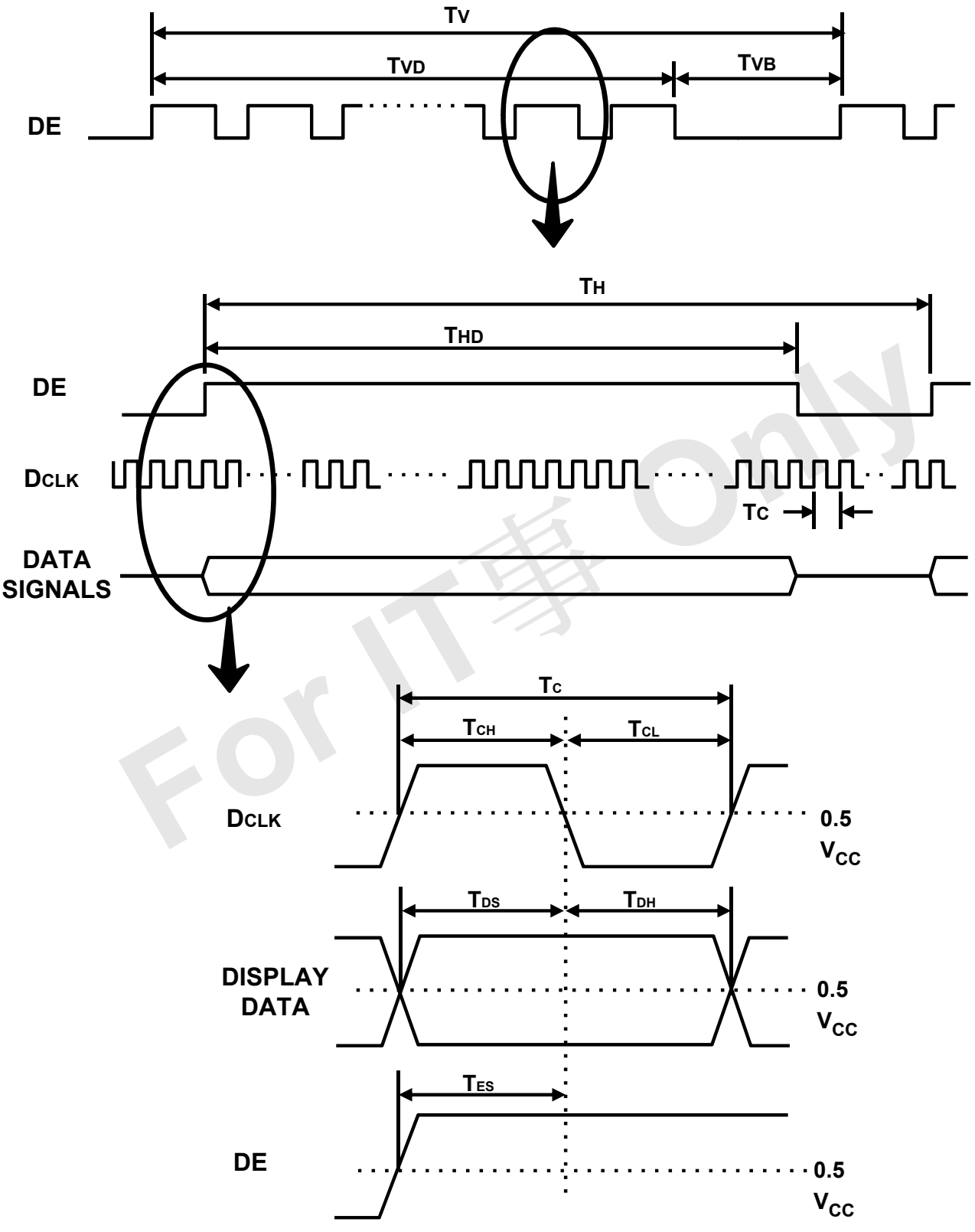
(2) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

(3) Internal Vcc = 5.0V

(4) Main Frequency Max MHz can be only applied when Spread-Spectrum not used . (Recommend to use Spread-Spectrum under 2%)

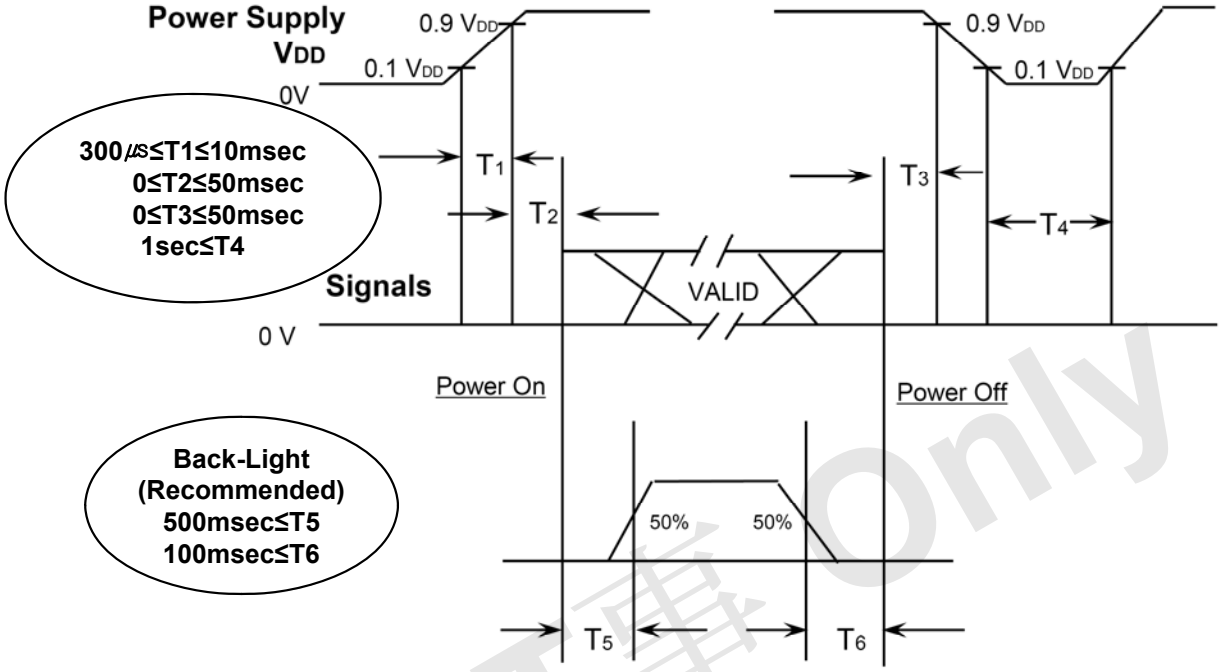
(5) Please only use Typ. Timing frequency, If different timing used, please contact SEC to discuss in advance.

6.2 Timing diagrams of interface signal (DE only mode)



6.3 Power ON/OFF Sequence

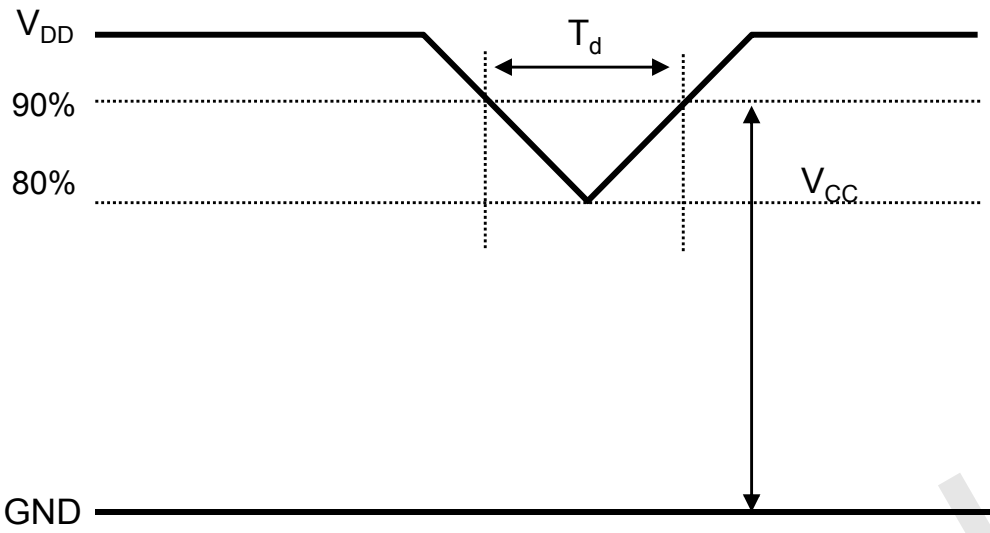
To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



T1 : V_{DD} rising time from 10% to 90%
T2 : The time from V_{DD} to valid data at power ON.
T3 : The time from valid data off to V_{DD} off at power Off.
T4 : V_{DD} off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD}.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V_{DD} = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.

6.4 VDD Power Dip Sequence



$4.5V \le V_{DD} \le 5.5V$
If V_{DD}(typ.) x 80% ≤ V_{CC} ≤ V_{DD}(typ) x 90%,
then 0<Td ≤20msec

Note (1) The above conditions are for the glitch of the input voltage.

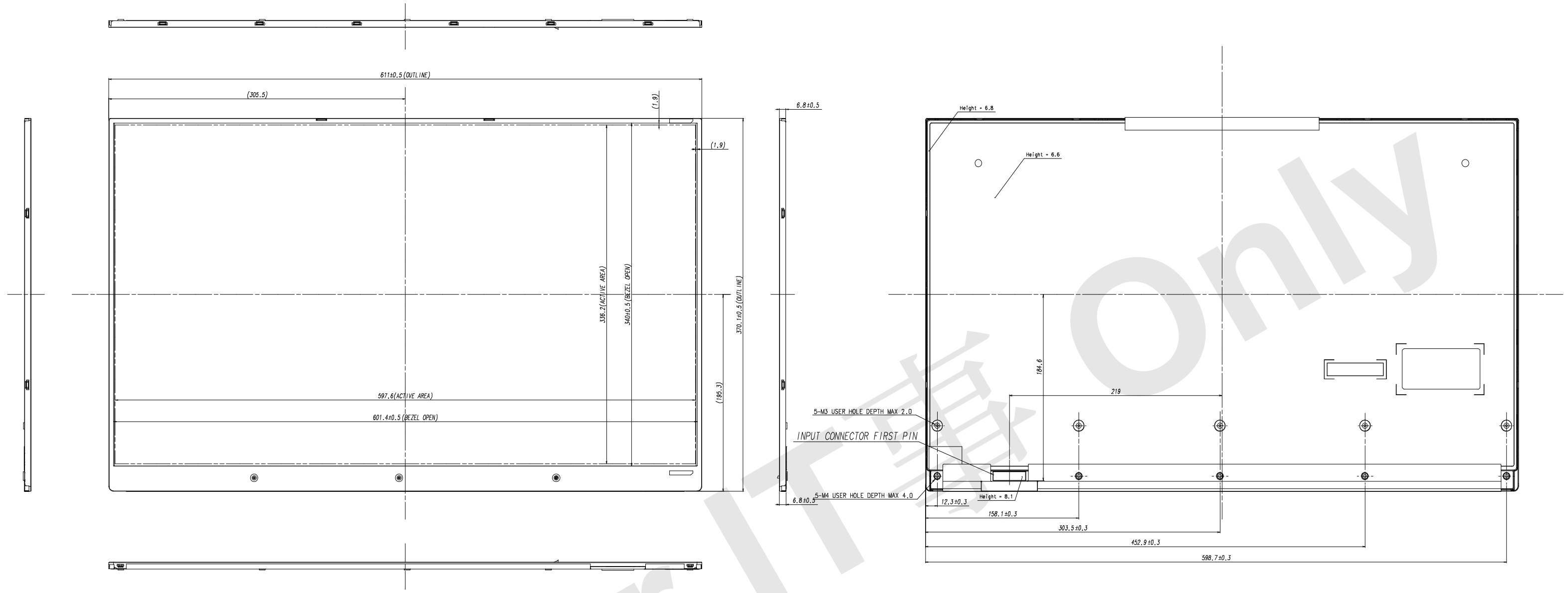
(2) For stable operation of an LCD Module power, please follow them.

i.e., if typ VDD x 80% ≤ Vcc ≤ typ VDD x 90%, then T_d should be less than 20ms.

7. Outline Dimension

[Refer to the next page]

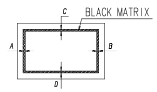
NO	PART NAME	CODE NO	SPECIFICATION	Q'TY	WEIGHT	REMARK



* NOTES

1. BACKLIGHT : WHITE LED
2. I/F CONNECTOR SPECIFICATION.
   - MAKER: Melex
   - PART NO: 3708-002867
     OR equivalent
3. SCREW TORQUE SPEC : 3 ~ 3.5 kgf-cm
4. BLACK MATRIX SPEC

- |A - B| ≤ 2.0 mm
- |C - D| ≤ 2.0 mm



GENERAL TOLERANCE			
STEP	LEVEL 1	LEVEL 2	LEVEL 3
0 < X ≤ 4	±0.05	±0.1	±0.2
4 < X ≤ 16	±0.08	±0.15	±0.3
16 < X ≤ 64	±0.12	±0.25	±0.5
64 < X ≤ 256	±0.25	±0.4	±0.8

REV	DATE	DESCRIPTION OF REVISION	REASON	CHG'D BY

UNIT	mm	DRA'N BY	DES'D BY	CHK'D BY	APP'D BY
SCALE	N / A	JH.SON			
TOLERANCE ±1		2010.09.30			

SAMSUNG ELECTRONICS

MODEL NAME	LTM270HU02(950s)		
PART/SHEET NAME	OUTLINE-DIM.	SHEET	1/1
SPEC. NO			
CODE NO.		VER.	00

8. Reliability Test

Test Items		Conditions	Time/Cycle	Sample
HTOL*		50°C , Bias	500 hrs	12
LTOL*		0°C , Bias	500 hrs	5
THB**		40°C / 95% , Bias	500 hrs	5
HTS***		70°C , No Bias	500 hrs	5
LTS***		-20°C , No Bias	500 hrs	5
Thermal Cycle		-20°C/30min ~ +60°C/30min , No bias	100 cycle	5
Shock (Non-operating)		50G , 11msec Sine wave , ± x/y/z axis	1 time/axis	3
Vibration (Non-operating)		1.5G , 5~200 Hz x/y/z axis , sweep rate : 10 min	30min/axis	3
ESD	Non-Operating	CDM : 150pF, 330**Ω**, 9point, 3 times/point	± 10kV	3
	Operating	Contact : 150pF, 330**Ω**, 100point, once/point	± 8kV	3
		Air(non-contact) : 150pF, 330**Ω**, 100point, once/point	± 15kV	3
Altitude		Thermal :-10~50℃, 15000ft(Operating), 40000ft(Non-operating)	8Hr	3
		Normal :45℃, 15000ft	10Hr	3

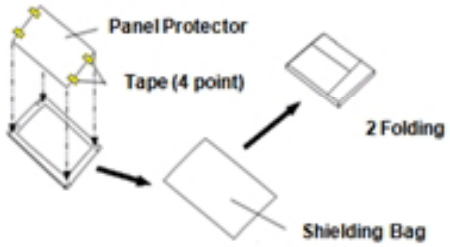
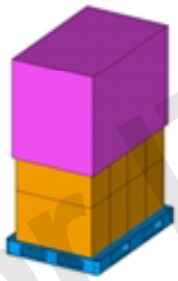
[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these should be no change which may affect practical display functions.

* HTOL/ LTOL : High/Low Temperature Operating Life
** THB : Temperature Humidity Bias
*** HTS/LTS : High/Low Temperature Storage

9. PACKING

9.1 CARTON

27" – 950s	Detail View	Remark	
Panel Protector Shielding Bag		Material	Panel Protector – PET T0.1 Anti-Static - under 10^9 (Single side to Pol.)
			Shielding Bag – LDPE + AL metallization + PET T0.08, Anti-Static - under 10^9
Packing Case		Material	Paper (SW,DW)
		Size	W239, L725, H380
		Q'ty	14 Panels with Silica Gel 120g / 1 Box
		Weight	32.8Kg / 1 Box
Pallet Stacking		Material	Pallet Box – Paper (SW) Pallet – Plastic, HDPE
		Size	Pallet Size – W850, L1150, H125 Stacking Size – W745, L1100, H868
		Q'ty	1*4*2 – 8 Packing Box 112 Panels / 1 Pallet
			270Kg / 1 Pallet (with Pallet Box, Pallet)

NOTE 1) TOTAL : Approx. 270Kg ± 5%

2) Box Material : Paper(SW, DW)

3) Box Size : 239W) x 725(L) x 380(H)

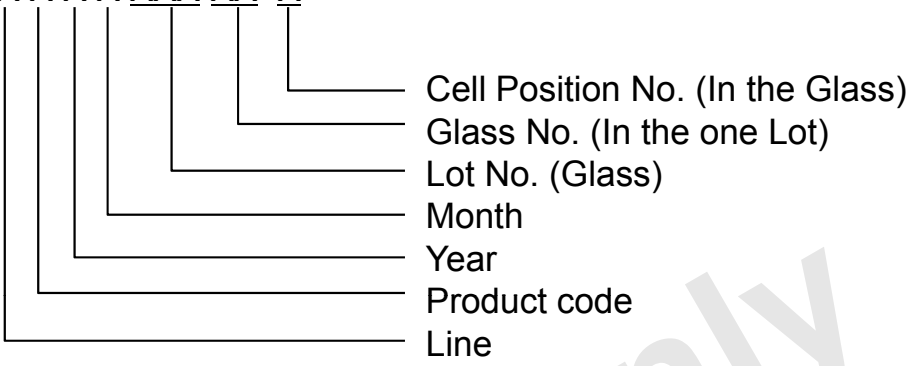
4) Packing Pallet Box Material : Paper(SW)

5) Packing Pallet Box Size : 745(W) x 1,100(L) x 868(H)

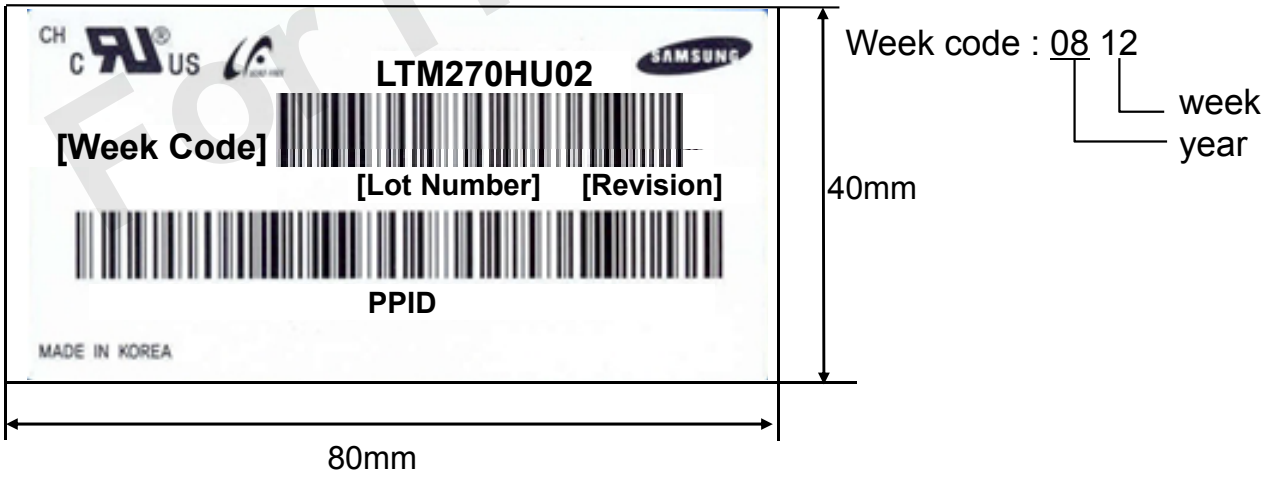
10. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

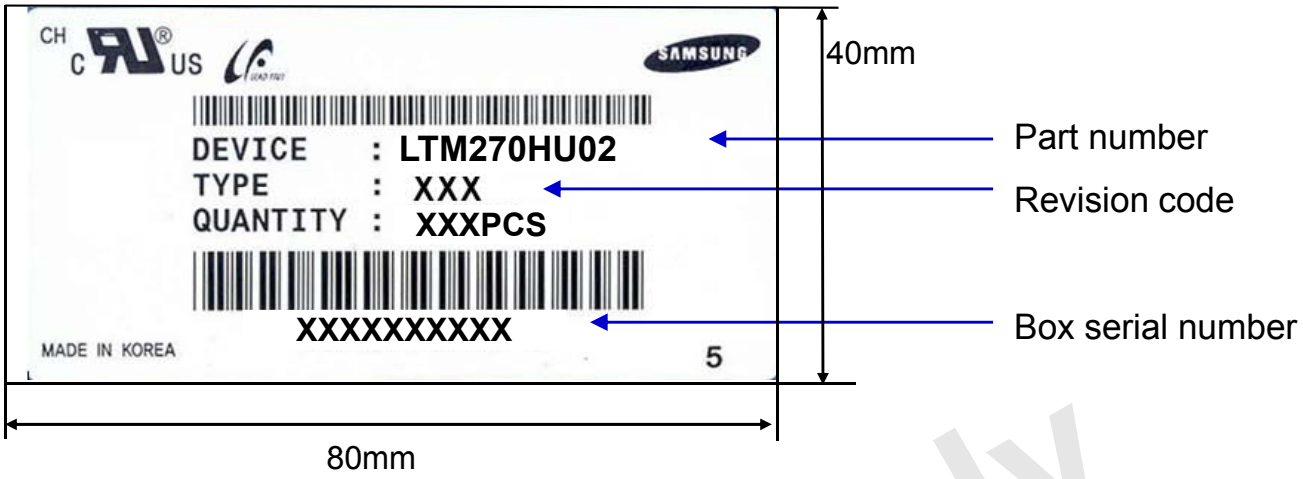
(1) Parts number : LTM270HU02
(2) Revision: Three letters
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



(6) Others

a. After service part

Lamps cannot be replaced because of the narrow bezel structure.

11. General Precautions

11.1 Handling

(a) When the module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the module.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, it may cause improper operation or damage to the module and LED back light.

(c) Note that polarizer films are very fragile and could be damaged easily. Do not press or scratch the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.

(f) Desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might cause permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.

(h) Protect the Module from static, or the CMOS Gate Array IC would be damaged.

(i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(j) Do not disassemble the Module.

(k) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.

(l) Pins of I/F connector should not be touched directly with bare hands.

11.2 Storage

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	- The storage room should provide good ventilation and temperature control. - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range, we recommend you leave them at a temperature of 20℃ and a humidity of 50% for 24 hours.		

11.3 Operation

(a) Do not connect or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off by the item 6.3 "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The cable between the back light connector and its inverter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

11.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : 20±15℃
- Humidity : 65±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

11.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.